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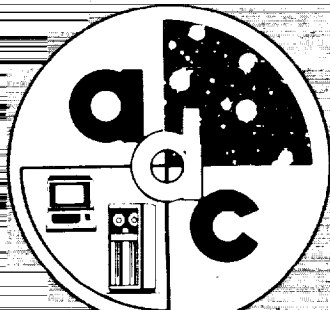
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A MULTIPLIET TABLE FOR Mn I

(Adelman, Svatek, Van Winkler, Warren 1989)

Documentation for the Machine-Readable Version



August 1989

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A MULTIPLET TABLE FOR Mn I

(Adelman, Svatek, Van Winkler, Warren 1989)

Documentation for the Machine-Readable Version

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Abstract

The machine-readable version of the multiplet table, as it is currently being distributed from the Astronomical Data Center, is described. The computerized version of the table contains data on excitation potentials, J values, multiplet terms, intensities of the transitions, and multiplet numbers. Files ordered by multiplet and by wavelength are included in the distributed version.

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1.0 Introduction

1.1 Description

A Multiplet Table for Mn I (Adelman, Svatek, Van Winkler, Warren 1989) was prepared by first calculating all possible transitions consistent with a change in J of 0, -1 , and $+1$ from the atomic energy levels of Mn I (Corliss and Sugar 1977). The transitions selected for inclusion were observed lines from Catalán, Meggers, and García-Riquelme (1964), Brown and Ginter (1978), and Baig, Connerade, and Newson (1979). Also included were predicted lines to complete multiplets in which one or more lines were seen by Catalán *et al.* (1964) and predicted multiplets contained in Kurucz and Peytremann (1975). These predicted transitions satisfy L-S coupling rules.

This document describes the machine-readable version of *A Multiplet Table for Mn I* as it is currently being distributed from the Astronomical Data Center (ADC). It is intended to enable users to read and process the computerized tables without problems and guesswork. Users should consult the source publication and the references to the original work that are cited in the bibliography at the end of this document for additional details. A copy of this document should be transmitted to any recipient of the machine-readable tables.

1.2 Source Reference

Adelman, S. J., Svatek, G. F., Van Winkler, K., and Warren, W. H. Jr. 1989, *Astron. Astrophys. Suppl.*, in press.

2.0 Structure

2.1 File Summary

The machine version of *A Multiplet Table for Mn I* consists of two files. Table 1 gives the machine-independent file attributes. All logical records are of fixed length, and, if the tables are received on magnetic tape, they will contain blocks of fixed length (as noted below), except that the last block of each file may be short. The first file contains a table ordered by multiplet, while the second contains the same table ordered by wavelength (λ).

<i>A Multiplet Table for Mn I</i> (Adelman, Svatek, Van Winkler, Warren 1989)				
File	Contents	Record Format	Logical Record Length	Total Number of Logical Records
1	Multiplet Order	FB	80	8427
2	Wavelength Order	FB	80	8427

Table 1. Summary Description of Catalog Files: FB = Fixed length blocks (last may be short)

The information contained in the above table is sufficient for a user to describe the indigenous characteristics of the machine-readable version of *A Multiplet Table for Mn I* to a computer. Information easily varied from installation to installation, such as block size (physical record length), blocking factor (number of logical records per physical record), total number of blocks, density, number of tracks, and character coding (ASCII, EBCDIC) for tapes is not included, but should always accompany secondary copies if any are supplied to other users or installations.

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2.2 Multiplet Table (Files 1 and 2 of 2)

The record format of the multiplet table is identical, except for the sorting order, in both files. The form is similar to that of *A Multiplet Table of Astrophysical Interest* (RMT, Moore 1945) and *An Ultraviolet Multiplet Table* (UMT, Moore 1959). The older multiplet numbers were retained wherever possible. New multiplet numbers begin with 61, while multiplet 12 contains lines from old multiplets 9, 10, and 13; UV 25 from old multiplet UV 26; UV 24 from old multiplet UV 28; and UV 37 from old multiplet UV 38.

Table 2 gives a byte-by-byte description of the contents of the data files. A suggested Fortran format specification for reading each data field is included and can be modified depending upon individual programming and processing requirements (Fortran 77 character string-type formats are used); however, caution is advised when substituting format specifications, since many data fields contain character data and others are blank when data are absent. In fact, for unclassified lines, the only information given is contained in the first 19 bytes of each record (bytes 20 through 80 are blank). Therefore, it is safest to buffer in records in an unformatted mode or read them with character (A) formats and test for blank data fields before processing with numerical formats for calculations and/or search purposes. For such fields, primary numerical format specifications are given to indicate decimal-point locations, while alternate A-type formats are specified in parentheses. Default (null) values are always blanks in data fields for which primary suggested formats are given as A.

Byte(s)	Units	Suggested Format	Default Value	Data
1-2	---	A2	---	Element (Mn)
3-4	---	I2	---	Atomic species number (1)
5-6	---	2X	---	Blank
7-15	Å	F9.3	---	Wavelength
16-18	---	3X	---	Blank
19	---	A1	---	Reference code
20-33	---	A14	---	Laboratory intensity
34-36	---	3X	---	Blank
37-40	eV	F4.2 (A4)	blank	Lower excitation potential
41-42	---	2X	---	Blank
43-47	eV	F5.2 (A5)	blank	Higher excitation potential
48-50	---	F3.1 (A3)	blank	Lower J value
51-53	---	F3.1 (A3)	blank	Higher J value
54	---	1X	---	Blank
55-58	---	A4	---	Lower term designation
59-64	---	A6	---	Higher term designation
65	---	1X	---	Blank
66	---	A1	---	Code
67-68	---	A2	---	Code for UV
69-75	---	F7.3	blank	Multiplet number
76	---	A1	---	Forbidden transition code
77-80	---	I4	---	Sequential number

Table 2. Data Files Record Format

Wavelength

Wavelength of the transition. They are in air except shortward of 2000 Å, where they are in vacuum. Note that the precision varies (the last two bytes can be blank).

Reference code

The reference codes are as follows:

A Catalán *et al.* (1964)

B Based on *gf* values of Kurucz and Peytremann (1975) using values of Catalán *et al.* (1964) as a guide for lines of similar excitation potential

	C Brown and Ginter (1978), but divided by 10
	D Baig <i>et al.</i> (1979)
	P Predicted line
	Users are advised to check the quality of each analysis from which the tables were assembled if uncertainties in identifications are encountered.
Laboratory intensity	This data field is divided into several uniform parts, the wide spacing being required to isolate the various segments of the field. Thus, it is possible to read the numerical intensities by using the format specification (A3,F6.1,A5) because character data are, in all cases, separate from the numerical intensities. Note, however, that a numerical intensity may be zero or blank. Also note that decimal points have been added to integer intensities so that the numerical field is always either a real number or blank. Parentheses in bytes 20 (left) and 32 (right) are used to indicate intensity scale changes and an asterisk (*) in byte 33 denotes that an intensity is affected by that of a neighboring, or impurity, line. Although numerical intensities may be read and tested upon or sorted, the overall data field must be considered for correct interpretation.
Lower excitation potential	All limits and energy levels given in cm^{-1} have been multiplied by the factor 0.000123981 to obtain the respective values in electron volts (see Moore 1965).
Higher excitation potential	Same comments as for lower excitation potential.
Lower J value	Value corresponding to the low level involved in the transition producing the line.
Higher J value	Value for high level. There is no specific secondary order of J values in the λ -ordered file when multiplet lines at an identical wavelength occur; <i>i.e.</i> , no secondary sorts were attempted beyond that on λ , since there is no rational way to order the lines beyond wavelength.
Term designations	Term designations from the source material, without the J values attached to them. The complete upper state designations from Brown and Ginter (1978) and Baig <i>et al.</i> (1979) are not given for lack of space, and some multiplets represent lines with unclassified upper states grouped together for convenience. These include many multiplets between UV 2.88 and UV 2.343.
Code	The following codes are employed: A Indicates a change from Catalán <i>et al.</i> (1964), <i>e.g.</i> , by the inclusion of additional lines of the same λ and differing J values, and where the upper limit term has been changed. B Major component.
UV code	The letters "UV" when a multiplet occurs shortward of 3000 Å (stated in Moore 1965). However, multiplets having $\lambda < 3000$ Å occur without the prefix and a few multiplets just longward of 3000 Å contain the prefix.
Multiplet number	Older multiplet numbers, as used in <i>RMT</i> and <i>UMT</i> , are used wherever possible. New multiplet numbers begin with 61. Note that the dual numbering system described by Moore (1965) (see p. vii) is used in principle, but that decimal points have been added to the integers so that all numbers are uniform in format.
Forbidden transition code	The letter "F" indicates a forbidden transition.

Sequential number

The multiplet-ordered table was assigned a sequential numbering to provide an independent means of ordering the table. This was done because if the multiplet table is disordered, it is virtually impossible (at least we couldn't find a way) to reorder it by machine sorting. The sequential numbers are, of course, retained in the λ -ordered table to indicate where the lines are located in the multiplet table.

3.0 History

3.1 Preparation of the Tables

The data were compiled and computerized by S. J. Adelman, G. F. Svatek, and K. Van Winkler with financial support from The Citadel Development Foundation. A complex coding system was used in the original file to indicate upper and lower case letters in the intensity field, blended lines (* in intensity field), changes from Catalán *et al.* (1964) in combination with other codes, and other combinations of individual codes. The format and coding system were extensively revised by W. H. Warren Jr. at the Astronomical Data Center in order to prepare a uniform file fully processable by machine, to replace all upper case characters by lower case where appropriate, to insert parentheses and asterisks, and to duplicate the format used in an earlier finding list for the NSRDS-NBS3 multiplet tables prepared by Adelman *et al.* (1985) to the extent possible. The complete table was sorted various ways to detect errors and was proofread in sections by S. J. Adelman. The final multiplet-ordered table was sorted by computer to produce the λ -ordered table.

4.0 Acknowledgments and References

4.1 Acknowledgments

The partial support of The Citadel Development Foundation toward the computerization of the tabular data is gratefully acknowledged.

4.2 References

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Appendix A. Sample Listing

The sample listing given on the following pages shows logical records exactly as they are recorded in the machine-readable version of the multiplet table. Groups of records from the beginning and end of each file are illustrated. The beginning of each record and the bytes within the record are indicated by the column heading index across the top of each page (digits read vertically).

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Input VOLSER ADC006

[illegible]

Record	8408 Mn 1	22530.34	P	7.15	7.705.55.5	t6f0	e6G	335.	8408
Record	8409 Mn 1	21717.01	P	7.15	7.724.54.5	t6f0	e6G	335.	8409
Record	8410 Mn 1	21139.10	P	7.15	7.743.53.5	t6f0	e6G	335.	8410
Record	8411 Mn 1	20752.47	P	7.15	7.752.52.5	t6f0	e6G	335.	8411
Record	8412 Mn 1	20503.40	P	7.15	7.761.51.5	t6f0	e6G	335.	8412
Record	8413 Mn 1	22530.34	P	7.15	7.706.55.5	t6f0	e6G	335.	8413
Record	8414 Mn 1	21717.01	P	7.15	7.725.54.5	t6f0	e6G	335.	8414
Record	8415 Mn 1	21139.10	P	7.15	7.744.53.5	t6f0	e6G	335.	8415
Record	8416 Mn 1	20752.47	P	7.15	7.753.52.5	t6f0	e6G	335.	8416
Record	8417 Mn 1	20503.40	P	7.15	7.762.51.5	t6f0	e6G	335.	8417
Record	8418 Mn 1	23228.49	P	7.15	7.695.56.5	t6f0	e6G	335.	8418
Record	8419 Mn 1	22530.34	P	7.15	7.704.55.5	t6f0	e6G	335.	8419
Record	8420 Mn 1	21717.01	P	7.15	7.723.54.5	t6f0	e6G	335.	8420
Record	8421 Mn 1	21139.10	P	7.15	7.742.53.5	t6f0	e6G	335.	8421
Record	8422 Mn 1	20752.47	P	7.15	7.751.52.5	t6f0	e6G	335.	8422
Record	8423 Mn 1	20503.40	P	7.15	7.760.51.5	t6f0	e6G	335.	8423
Record	8424 Mn 1	25464.16	P	7.20	7.695.56.5	y4G0	e6G	336.	8424
Record	8425 Mn 1	24842.91	P	7.20	7.704.55.5	y4G0	e6G	336.	8425
Record	8426 Mn 1	24009.23	P	7.21	7.723.54.5	y4G0	e6G	336.	8426
Record	8427 Mn 1	23430.69	P	7.21	7.742.53.5	y4G0	e6G	336.	8427

